images of these stars as compared with the corresponding apparent distance on the sky serves to furnish a determination of the scale of the plate, while the direction of the line joining them serves to fix the orientation of the plate, *i.e.* enables us to turn the plate round in its own plane, so that the true N. and S. line may be placed exactly in a truly horizontal, truly vertical, or, in fact, any other desired direction. With these quantities correctly assigned, either star will be sufficient to correlate the plate exactly with the sky. In practice it is customary to refer to a larger number of stars than two on each plate. Not only are the determination of these necessary "plate constants" strengthened thereby, but in the consistency with which the photographic pictures reproduce the actual distribution of the stars, we have a valuable check on our methods and a test of the faithfulness with which also other features on the sky are represented on the photographs. For the Cape plates, the determination of the "plate constants," *i.e.* of those elements which serve, as it were, for the coordination of the isolated maps contained on each plate with a general map of the whole, has been made to depend on a number of stars on each plate varying, as a rule, between 8 and 12. In all, 8560 stars, so far as possible evenly distributed over the whole of the zone, were selected as comparison stars. These stars constitute a framework to which the detailed results derived from the photographs may be attached, but the structure of which requires to be independently built up. For such a purpose, photographic methods have not as yet proved available, and recourse was necessary to the older method of visual observing with the meridian circle. From observations made in the years 1897–1900 with the transit circle an accurate catalogue of these 8560 stars has now been formed, and has been utilised for the purpose of standardising each of our plates. The heavy arithmetical work involved in applying to each of our original measures more than two millions in number, the derived correction to refer the whole to a common standard is now rapidly proceeding, and at the present time is about half completed.

I have above referred to the catalogue of 8560 comparison stars as framework for the support of the more extensive photographic catalogue. Such a framework, at least on the basis on which the one was constructed, is not entirely self-supporting, and it thus behoves us to carefully consider its foundations and to ensure that they possess the necessary solidarity. Not the least of the important questions brought up for discussion at the last meeting of the International Committee charged with the conduct of the photographic work was that of the steps to be taken for this purpose. It was recognised on all sides that even the best existing meridian catalogues were inadequate, and that they would have to be supplemented by extensive additional observations. The main object of the discussion was to secure the most extensive cooperation from observatories provided with suitable meridian equipment, and to classify the work in various grades of accuracy, so that each establishment might devote itself primarily to that branch for which its equipment was best adapted, at the same time keeping in view the coordination of its work with the larger scheme. The resolutions adopted have since been favourably received by meridian observers, and we may look in the future to a systematic organisation of meridian astronomy throughout the world, the results of which, apart from the mere economic aspect, cannot fail to be of the highest importance to science. It may well be asked, What is the use of such a chart as you have been describing? or, Will it repay the enormous cost involved in compiling it? As regards its use, I endeavoured to indicate in my address last year some of the problems which awaited solution, and which serve to inspire the astronomer in conduct of the lengthy routine operations involved. These motives are, perhaps, for the most part scientific and intellectual rather than utilitarian, and it is possible, even probable, that to many of the questions arising answers which will afford complete satisfaction will not be forthcoming at least for a generation or two to come. I think I am sufficiently voicing the view of those who took part in the original discussions at Paris when I state that they, as a body, attached greater importance to the complete and thorough systematic record of the phenomena prevailing during their own generation than to the immediate interpretation of these phenomena. It was felt to be a scientific duty, incumbent on them to provide, so far as lay within their means and capacity, data which should be beyond reproach. By this means they were preparing the ground and planting the seed, which they hoped would yield a rich crop of scientific results, even though it should remain for their children's children to reap the harvest.

Much has already been attained. The ghosts which beset the use of photography in relation to the science of exact measurement have in a large measure been laid, and photographic methods have now been successfully used for some of the most delicate measurements ever attempted even by direct visual operation. I have in mind such questions as the determination of the distance of annual parallaxes of the fixed stars, and of the parallax of the sun, in connection with which, under the auspices of the Paris conference, an extensive photographic campaign, combined with visual methods, was undertaken on the occasion of the near approach of the planet Eros in the years 1900–1. The discovery of the latter planet was itself a product of photography, while by similar means the number of known minor planets has within the last few years increased by leaps and bounds, until at the present day they are nearly seven hundred in number. Photography has also been prolific in the discovery of variable stars and new stars, and the tracing of their light changes. All these purposes will be greatly facilitated by the existence of a trustworthy chart or catalogue containing more especially the fainter stars about which our exact knowledge hitherto has been almost non-existent. Time must elapse before we may expect to be able to evaluate with any certainty the slow changes of position due to the proper motion, at least, in relation to the previously uncatalogued faint stars; but this is to-day one of the greatest desiderata for the advancement of our knowledge of the universe, and is one of the purposes for which the photographic catalogue was primarily intended. By photographic methods and by cooperative effort throughout the world alone has it been possible to collect evidence on a sufficiently wholesale scale, so that already we are beginning to feel the solution of some of the most profound problems relating to the universe almost within our grasp.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Public Orator, Dr. Sandys, spoke as follows in presenting for the degree of Doctor in Science, *honoris causa*, (1) Dr. G. E. Hale, director of the Solar Observatory on Mount Wilson, California, and (2) Prof. T. W. Richards, professor of chemistry in Harvard University:—

(1) Adest vir in republica maxima transmarina caeli in orbibus observandis iam per annos plurimos maximo cum fructu exercitatus, qui Californiae sub caelo sereno, montis Wilsonii in vertice excelso, instrumentis novis adhibitis, solis ipsius materiem exquisivit et stellarum remotissimarum mutationes investigavit. Rerum caelestium auguri tam perspicaci stellarum ipsas origines nebularum (ut aiunt) formae obscurae illustrant; stellae autem colore primum candido, deinde flavo, denique rubro coruscantes, orbium illorum vitam per seriem exorientem, maturescentem, deficientem indicant; orbis denique terrarum noster quasi imago stellae est ex qua lumen calorque iam dudum evanuerunt. Newtoni nostri in Opticis dicitur in montibus summis, supra nubes densiores, in aëre maxime sereno et tranquillo, stellas melius posse observari:[1] gratulamur auguri nostro caelesti quod Californiae in monte altissimo arcem nactus est, caelo observando tam opportunam, unde orbis terrarum incolis vallium et camporum in obscuritate degentibus rerum naturae lucem ipsam possit desuper transmittere. Viro tot titulis aliunde cumulato, etiam nostram coronam libenter donamus.

Duco ad vos astronomum insignem, Georgium Ellery Hale.

(2) Filiam suam, aequore Atlantico a se divisam, studiorum communium amore coniunctam, mater alma

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[1] Newton's "Optics," Book I., part i., *ad finem*.

Cantabrigiensis non sine superbia quadam contemplatur. Ergo matris almae nomine scientiae chemicae professorem Harvardianum non sine gaudio salutamus, virum et inter suos et inter Germanos doctrinae in sedibus sex praeclaris educatum. Quod si Latino potissimum in sermone de meritis eius vultis admoneri, videor mihi "propter egestatem linguae et rerum novitatem"[1] rem admodum difficilem ingredi. Peritis tamen comprobavit, sese, in rerum elementis fere quindecim, atomorum pondera ipsum comperisse, atque discipulis suis primordiorum tam minutorum subtilissime examinandorum exemplum praetulisse viamque ostendisse. Idem primus indicavit, elementi cuiusque in atomo quo minor vis insit, eo artius elementum illud comprimi posse. Idem etiam metallorum in provincia, computationibus usus accuratissimis, Faradii legem quandam praeclare confirmavit. Academiae nostrae, scientiarum accuratarum cultrici tam assiduae, pro certo novimus rerum exploratorem tam accuratum perquam esse cordi.

Duco ad vos scientiae chemicae professorem accuratissimum, Theodorum Willelmum Richards.

The general board of studies has reappointed the following university lecturers from October 1, 1911, until September 30, 1916, and the appointments have been confirmed by the special boards with which they are connected:—Botany, A. G. Tansley; mathematics, H. W. Richmond and R. A. Herman; pathology, Dr. Cobbett.

Dr. James, Provost of King's College, has been nominated to represent the University at Rennes on the occasion of the inauguration, in October, of new university buildings and of a monument commemorative of the union of Brittany with France.

The board of managers gives notice that an Arnold Gerstenberg studentship will be offered for competition in the Michaelmas term of 1912. The competition will be open to men and women who have obtained honours in part i. or part ii. of the natural sciences tripos, and whose first term of residence was not earlier than the Michaelmas term of 1906.

GLASGOW.—Captain Lyons, F.R.S., has announced his resignation of the University lectureship in geography, on his removal to London to take up his duties at the Royal Geographical Society. He has succeeded in establishing a flourishing department at the University, where geography is now recognised as a subject for the M.A. and for the B.Sc. degree. The University Court will proceed to make an appointment to the office during the summer.

Prof. R. A. Stewart Macalister, of Dublin, has been appointed Dalrymple lecturer in archæology for the ensuing academical year.

A scheme for the affiliation to the University of the Glasgow and West of Scotland Technical College has received the approval of the Scottish Universities Committee of the Privy Council. Ordinances for the purpose of carrying the scheme into effect and admitting the students of the college to university privileges and degrees will now be framed and laid before Parliament in due course.

The Royal Infirmary of Glasgow has received a new charter, which, *inter alia*, provides for the representation of the Court and Senate of the University on its board of management. From the University side an ordinance has been promoted, and now awaits the approval of his Majesty in Council, which establishes four new professorships at the Royal Infirmary, namely, in medicine, surgery, obstetrics, and pathology. The existing (regius) chairs in these subjects continue to be connected with the Western Infirmary. Both institutions, which between them contain about 1200 beds and well-equipped extern departments, will thus have equal rank as the clinical schools of the University. All the instruction provided at the Royal Infirmary will be open to women students of the University on the same terms as to men. A new clinical laboratory for study and research has been erected at the Western, to which a director will presently be appointed. A pathological institute on a large scale, including a clinical laboratory, is approaching completion at the Royal; and by the gift of an anonymous benefactor, a similar building is in progress at the Victoria Infirmary, which will also be available for university students. The medical school of Glasgow is becoming one of the best equipped in the country, especially as regards its provision for scientific teaching and investigation.

OXFORD.—On Tuesday, June 13, another stage was reached in the discussion of the proposed statute exempting students of natural science and mathematics from compulsory Greek. An amendment prohibiting exempted candidates from offering themselves in any other final honour school except these two was carried by 93 to 36. A further amendment, moved by the Master of Balliol, which sought to limit the exemption to candidates who should obtain certain qualifications before entering the University, was rejected by 105 to 39. The statute as amended will now be submitted to Congregation, and if it passes will come before Convocation for final decision.

Prof. John Milne, F.R.S., has been appointed Halley lecturer for 1912.

WE learn from *Science* that Mr. T. C. Du Pont has given 100,000*l.* to the Massachusetts Institute of Technology toward its proposed new site. Announcement is also made of two bequests of about this amount. A trust fund of between 100,000*l.* and 120,000*l.*, created by Mr. Francis B. Greene some five years ago, will be received by the institute for the assistance of students, and it will receive nearly 100,000*l.* from the bequest of Mrs. Emma Rogers, widow of the first president of the institute. These large gifts, in addition to the 20,000*l.* for ten years voted by the State, will make it possible for the institute to purchase a new site and erect the necessary buildings. From the same source we learn that, by the will of Mrs. Lydia A. Barnard, of Milton, Mass., Radcliffe College receives 23,000*l.* and Harvard University 12,000*l.*

THE fourteenth annual Conference of the National Head Teachers' Association was held in Manchester last week. The association adopted a resolution to the effect that no exemption should be allowed from school attendance until the age of fourteen has been reached; that there be compulsory attendance at continuation schools from the age of fourteen to seventeen; that a well-devised scheme of physical development of young people should form part of the curriculum of every continuation school; that it be the statutory duty of every local education authority to make suitable provision for the carrying on of such continuation schools in its area as may be necessary; that the Government provide suitable grants for this purpose; and that it should be the statutory duty of employers of young persons under seventeen to enable them to attend continuation classes at such hours as may be required by the Act.

THE Department of Agriculture and Technical Instruction for Ireland would appear to have adopted the view that geography is a science, and should be taught as such in schools. For the session 1911–12 a course of physical and commercial geography will form one of the subjects of experimental science which may be taken up in Irish intermediate schools. Anticipating the difficulty which principals of schools may experience in finding teachers competent to deal with geography in a scientific manner, the Department is arranging for a summer course of instruction in the subject, to be held, from July 4 to 28, at the Royal College of Science, Dublin, for teachers who have already qualified themselves in elementary experimental science. The Department has circulated an outline syllabus in physical and commercial geography suitable for pupils in their third and fourth years. The work for the former year includes a practical study of the geography of the home district; the figure, motions, and position of the earth; the atmosphere; the land; and the general geography of Ireland. The fourth year's work comprises the physical geography of the sea and a course of commercial geography of a general kind.

THE second volume of the report of the U.S. Commissioner of Education for the year which ended on June 30, 1910, is now available. The 746 pages are devoted almost exclusively to statistics, which supplement in an admirable manner the descriptive articles in the previous volume, already noticed in these columns.

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[1] Lucretius, i. 139.

During the year under review, the Bureau of Education at Washington received reports from 602 universities, colleges, and technological schools in the United States. Of these, 142 are for men only and 352 for both sexes. The entire teaching force of these 602 institutions of higher education numbered 27,279. The aggregate enrolment of students reached 301,818, including students in all departments—preparatory, collegiate, graduate, and professional. The aggregate of gifts and bequests reported by the 602 institutions for the year 1909–10 was 3,747,430*l.* Of this amount, 1,228,700*l.* was given for buildings and improvements, 1,954,200*l.* for endowment, and the remainder for current expenses. The largest amounts were received by the following institutions:—Columbia University New York, 409,000*l.*; Yale University, Connecticut, 403,000*l.*; Princeton University, New Jersey, 342,000*l.*; University of California, 248,000*l.*; University of Chicago, Illinois, 239,000*l.*; and Bryn Mawr College, Pennsylvania, 142,000*l.* Twenty-seven institutions altogether each received 20,000*l.* or more during the year.

The report for the year 1910 of the council to the members of the City and Guilds of London Institute is now available. During the year a petition was made to the King for a supplemental charter to enable the institute to cooperate more effectively with other bodies in the coordination of technological work, more especially in the metropolis, and on December 16, 1910, the supplemental charter was granted, and its provisions are printed in the report. The Imperial College of Science and Technology has obtained from the Commissioners of the Exhibition of 1851 a grant of a large piece of land at South Kensington, on part of which a building is being erected which will eventually be added to the Central Technical College, and will with that college form the engineering section of the Imperial College. The enlarged college, towards the cost of which the Goldsmiths' Company has made a grant of 50,000*l.*, will be known as "The City and Guilds College" (Engineering), thus perpetuating the connection of the institute with the engineering work in London. Among other matters, it may be noted that the course in railway engineering for post-graduate and other duly qualified students, organised by the college in 1908–9 in connection with the Imperial College of Science and Technology, has been continued and considerably enlarged. Reports are included also of the year's work at the City and Guilds Technical College, Finsbury, the South London School of Technical Art, and the Department of Technology.

In a suggestive article on "Scientific *versus* Personal Distribution of College Credits" (*Popular Science Monthly* for April), President William T. Foster, of Reed College, Portland, Oregon, directs attention to the want of a uniform standard in the classification of students in different subjects in American universities and colleges, but his criticisms are equally applicable to similar institutions on this side of the Atlantic. Adopting the system of grading students in five classes, of which four represent a pass and the fifth represents failure, the author tabulates for several colleges the percentages of students receiving the several grades in different departments, and the numbers show very large discrepancies. Thus in Harvard College in one year the percentage of students in the highest grade varied from 1 per cent. in English to 35 in Greek; in the second grade from 11 per cent. in English to 33 per cent. in fine arts, and so forth. The result of these discrepancies is that the poorer students seek the courses which give the larger proportions of high grades. The author points out that to all students who are prompted by unworthy motives his charts indicate the easiest way to a degree; moreover, it is useless to suppress such information, as students in all colleges are guided by such charts more or less accurately plotted. In the University of Missouri, on the other hand, a system has been introduced of equalising for different departments the percentages of students placed in the several classes, with the result that "we come nearer to knowing what a grade stands for at the University of Missouri than at any other institution in the country." For this purpose a normal distribution is adopted in which 25 per cent. of the students are in the first two classes, 50 per cent. in the middle class, and 25 per cent. in the fourth and fifth. The author suggests that instructors should be required to tabulate the actual distribution of grades in their departments each year, and that all marked divergences from the normal distribution should be made the subject of a special report.

SOCIETIES AND ACADEMIES.

London.

Royal Society June 1.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. R. **Kennedy**: Experiments on the restoration of paralysed muscles by means of nerve anastomosis. This communication is the first of three series of experiments on restoration of paralysed muscles by means of nerve anastomosis. The present series consists of ten experiments on monkeys and dogs, in which, after division of the facial nerve, the peripheral segment of the latter was attached to a neighbouring nerve. Sometimes the hypoglossal and sometimes the spinal accessory was the substitute. The experiments also varied in mode of uniting the nerves, and in interval of time elapsing between section of the facial and union with the substitute. Among the conclusions are the following:—Where spinal accessory or hypoglossal is substituted for facial nerve, restoration of voluntary co-ordinated movements of facial muscles is possible. Restoration commences sooner when the hypoglossal is used, although the ultimate results, so far as recovery of facial movements is concerned, do not appear to show much difference. On the other hand, the new paralysis produced temporarily or permanently in the distribution of the substitute nerve is more serious when the hypoglossal is employed. Where association movements are present in consequence of the anastomosis, these are more objectionable when the hypoglossal is used. As regards interval of time between section of the facial and performance of anastomosis, there is no decided difference in date of commencing recovery between immediate anastomosis and a secondary anastomosis after the lapse of one month. An addendum gives a report, twelve years after operation, of a case of spino-facial anastomosis published in Phil. Trans., 1901; also of a case of facial paralysis of three years' standing in which spino-facial anastomosis was done, and in which recovery commenced three years subsequently.—Sir David **Bruce**: The morphology of *Trypanosoma evansi* (Steel). In previous papers published in the Proceedings the morphology of various trypanosomes, such as *Trypanosoma pecorum*, *vivax*, *uniforme*, *nanum*, and *brucei*, has been described somewhat more fully than is usually done. It is proposed to do the same for *T. evansi* in this paper. This trypanosome causes the disease in elephants, camels, horses, cattle, and dogs known in India as surra. It was discovered in 1880 by Evans in the Punjab. It is curious that in India this is the only pathogenic trypanosome of the domestic animals which has up to the present been described. In Africa many species are known—in fact, here may be said to be the home of the trypanosome diseases. In Africa these diseases are associated with tsetse-flies. In India there are no tsetse-flies. The carrier of surra has not yet been identified. It is generally thought that surra has been introduced into Africa by means of the camel, but this is by no means established. Up to the present it has been usual to look upon the trypanosomes of surra and nagana as indistinguishable morphologically. In this paper 820 individuals of *T. evansi* have been carefully measured, and a curve representing the distribution in respect to length made. This curve is very different from that of *T. brucei.* It is therefore evident there should be no difficulty in future in separating these two species by this means. Again, on comparing the curve of the Indian camel disease with that of the African, the similarity is very striking, and affords some proof that the two diseases are caused by the same species of trypanosome.—H. S. **Stannus** and Dr. W. **Yorke**: The pathogenic agent in a case of human trypanosomiasis in Nyasaland. During the past three years a considerable number of cases of human trypanosomiasis have occurred in Nyasaland, notwith-